Power - Diode

Power diodes are also similar to signal diodes but have a little difference in its construction.

In signal diodes, the doping level of both P & N sides is same and hence we get a PN-Junction.

In power diodes, we have a junction formed between a heavily doped P^+ & a lightly doped N^- layer. N^- layer is epitaxially grown on a heavily doped N^+ layer.

The N^- layer is the key feature of the power diode which makes it suitable for high power applications. This layer is lightly doped, almost intrinsic & hence the device is known as PIN diode, where I stands for intrinsic.

Applications of Power Diode -

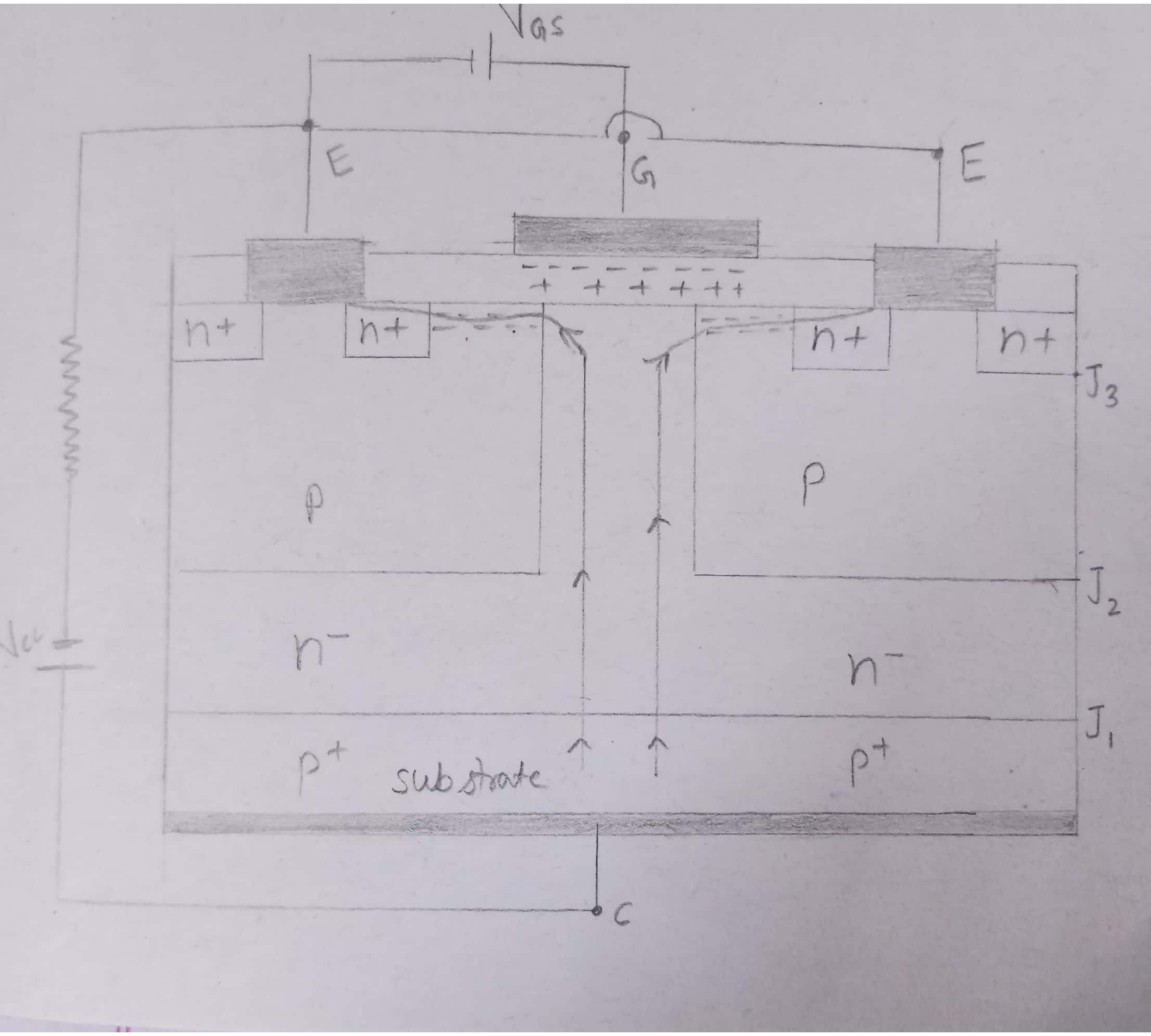
(i) Battery charging
(ii) AC rectifiers
(iii) Inverters
(iv) Free wheeling diodes
(v) Frequency rectifier.

IGBT
(Insulated Gate Bipolar Transistor)

IGBT is a voltage controlled power electronics device. It is a device which combines the fast acting features and high power capability of bipolar transistor with the voltage control features of MOSFET gate.

Construction -

It has three terminals collector, emitter & gate. The structure of IGBT is plain & similar to vertical power MOSFET, excluding P^+ injecting layer.



Working -

When collector is made positive w.r.t. emmiter, IGBT gets forward bias. Without no voltage between gate & emitter, two junctions between n^- & p-region (i.e., J_2) are reverse bias, so no current flows from C to E.

When G is +ve w.r.t. E, with V_{GE} voltage, an n-channel or inversion layer is formed. This n-channel short-ckt. the n^- & n^+ emitter region. Electrons begin to flow from n^+ to n^- region through n-channel. As

As IGBT is in F.B., p^+ injects holes into n^- region. The h^+ (injection carrier) density in n^- region increases & conductivity of n^- region enhances. Therefore IGBT gets turned on & begins to conduct forward current I_C.

$$I_C = I_E = I_h + I_e$$

Symbol -